

[Name of Document] What Is Claimed Is

[Claim 1] A plasma processing apparatus that processes a substrate in a process vessel by plasma generated by supply of a microwave, the apparatus comprising:

5 a transmissive window made of a dielectric to airtightly cover an upper opening of the process vessel; and

a support part supporting, in the process vessel, a peripheral edge portion of said transmissive window,

wherein said transmissive window has, in a center area thereof, a
10 hanging portion made of a same material as a material of said transmissive window, and a gap with a predetermined distance or more is formed between an outer peripheral surface of the hanging portion and said support part or a sidewall inner surface of the process vessel continuing from said support part.

[Claim 2] The plasma processing apparatus according to claim 1,
15 wherein the predetermined distance is 0.5 to 10 mm.

[Claim 3] The plasma processing apparatus according to claim 1, wherein the predetermined distance is 0.5 to 5 mm.

[Claim 4] The plasma processing apparatus according to claim 1, wherein the outer peripheral surface of the hanging portion is a tapered
20 surface with the gap gradually becoming larger toward a lower side.

[Claim 5] The plasma processing apparatus according to claim 1, wherein a recessed portion is formed in a center side area of the hanging portion.

[Claim 6] The plasma processing apparatus according to claim 5,
25 wherein a sidewall forming the recessed portion is a tapered surface inclining toward a center side of the recessed portion.

[Claim 7] The plasma processing apparatus according to claim 5, wherein a width of the hanging portion is $\lambda/4$ or less, where λ is a wavelength of the microwave in said transmissive window.

[Claim 8] The plasma processing apparatus according to claim 1,
5 wherein L/D is equal to 3 or more, where L is a vertical length of the hanging portion and D is the predetermined distance.

[Claim 9] The plasma processing apparatus according to claim 1, wherein a vertical length of the hanging portion is 20 mm or more.

[Claim 10] The plasma processing apparatus according to claim 1,
10 wherein at least one of surfaces, in said support part or the sidewall continuing from said support part, facing an inside of said process vessel is coated with Y_2O_3 (yttria).

[Claim 11] A plasma processing apparatus that processes a substrate in a process vessel by plasma generated by supply of a microwave, the apparatus
15 comprising:

a transmissive window made of a dielectric to airtightly cover an upper opening of the process vessel; and

a support part supporting, in the process vessel, a peripheral edge portion of said transmissive window,

20 wherein under said support part, an eave portion projecting into the process vessel is provided to be apart from a lower surface of said transmissive window by a predetermined distance or more.

[Claim 12] The plasma processing apparatus according to claim 11, wherein the predetermined distance is 0.5 to 10 mm.

25 [Claim 13] The plasma processing apparatus according to claim 11, wherein the predetermined distance is 0.5 to 5 mm.

[Claim 14] A plasma processing method using a plasma processing apparatus that processes a substrate in a process vessel by plasma generated by supply of a microwave, the plasma processing apparatus comprising: a transmissive window made of a dielectric to airtightly cover an upper opening
5 of the process vessel; and a support part supporting, in the process vessel, a peripheral edge portion of the transmissive window, wherein the transmissive window has, in a center area thereof, a hanging portion made of a same material as a material of the transmissive window, and a gap is formed between an outer peripheral surface of the hanging portion and a sidewall
10 inner surface of the process vessel continuing from the support part, and the method comprising

adjusting size of the gap to control strength of an electric field in a peripheral portion of the transmissive window.

[Claim 15] The plasma processing method according to claim 14,
15 wherein the outer peripheral surface of the hanging portion is a tapered surface with the gap gradually becoming larger toward a lower side, and

wherein the strength of the electric field in the peripheral portion of the transmissive window is controlled by adjusting a taper angle of the
20 tapered surface instead of adjusting the size of the gap.